PHYSICS
CLASS

RUBE GOLDBERG MACHINE

A Rube Goldberg machine uses a set of chain reactions that are intentionally designed to trigger one event after another until the final event is triggered.

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INTRODUCTION

This project is designed as a Rube Goldberg machine in accordance with the roller coaster assigned by the instructor. It comprises daily-product material, pulley, and catapult which included physics methods. Mechanical energy, kinetic energy, potential energy, velocity, work, force, and acceleration are a proportion of the physics method used in this project.

The project construction has covered seven weeks to accomplish. All of the members were trying their best to present the most outstanding model.

QR code to video:

CALCULATIONS

SPIRAL

Spiral

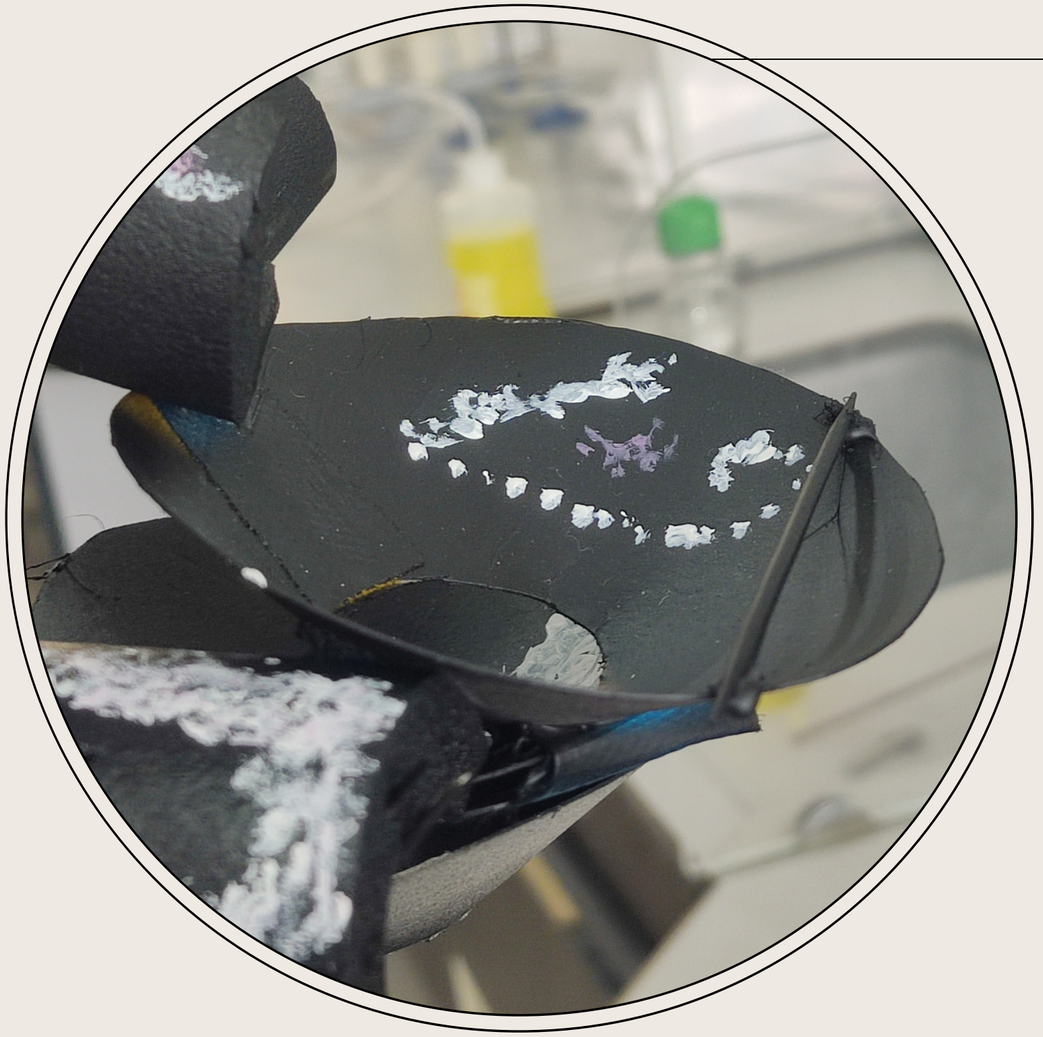
$$ME = KE_i + \varepsilon PE$$

$$ME = 0 + m_{marble} g h_i$$

$$ME = 0.00525kg \times 9.81\, m/s^2 \times 0.59m$$

$$ME = 0.0304\, Joules$$

$$Vertical\ displacement = 0.59\, m\ down$$



FUNNEL

$$\text{PE} = 0.00525\,kg \times 9.81 m/s^2 \times 0.385\,m$$
$$\text{PE} = 0.01983$$
$$\text{KE} = \text{ME} - \text{PE}$$
$$\text{KE} = 0.0304\ \text{J} - 0.01983\ \text{J} = 0.01057\ \text{J}$$

To get the velocity as the ball is going down into the funnel

$$\text{KE} = \frac{1}{2}mv^2$$
$$= \frac{1}{2} \times 0.00525kg \times v^2 = 0.01057$$
$$(2.625 \times 10^{-3}) \times v^2 = 0.01057$$
$$v^2 = 4.0267$$
$$v = 2.0067\,m/s$$

Funnel circular motion

$$a_c = \frac{v^2}{r}$$

$$= \frac{2.0067^2}{0.045} = \frac{4.0267}{0.045} = 89.48\ m/s^2$$

$$F_c = ma = 0.00525kg \times 89.48\ m/s^2 = 0.4698\ N$$

PULLEY

As one side was pulled down by the force of the car, the other side was pulled up to balance.

Pulley

Mass of car = 0.03447 kg

F=ma

$$F = 0.03447\ kg \times 9.81\ m/s^2 = 0.3382\ N$$

This is mentioned in Newton's second law which states every force will have an equal magnitude and opposite direction force on. it.

CATAPULT

Torque of catapult

$$\cos\Theta = \frac{adjacent}{hypotenuse} = \frac{9.5}{11} = cos30$$

$$F_g = mg = 0.045309\,kg\,(of\ sandball) \times 9.81\,m/s^2 = 0.444\,N$$

$$\tau = Fdcos\Theta = 0.444 \times 11 \times cos30 = 4.2297\,N \cdot m$$

Distance that the ball traveled in catapult

$$\tan\Theta = \frac{27.5}{27} = 45.5$$

$$a^2 + b^2 = c^2$$

$$27.5^2 + 27^2 = c^2$$

$$\sqrt{1485.25} = \sqrt{c^2}$$

$$38.54\,cm$$

$$0.3854\,m$$

COLLISION

Momentum

$$m_1 v_{1i} + m_2 v_{2i} = (m_1 + m_2) v_f$$

$$(0.00231)(22.86) + 0 = (0.00231 + 1.6 \times 10^{-4})(31.94)$$

$0.0528066 \text{ kg} \cdot m/s = 0.0789 \text{ kg} \cdot m/s$

0.026 difference

$m_1(pingpong) = 0.0023 \text{ kg}$

$m_2(foam\ ball) = 1.6 \times 10^{-4} kg$

$v_{1i} = \frac{m}{s} = \frac{40}{1.75} = 22.86\ m/s$

$v_{2i} = 0\ m/s$

$v_f = \frac{34.5}{1.08} = 31.94\ m/s$

This is due the force of gravity on the two balls after they collided so their final measured velocity actually increased. This is why conservation of momentum wasn't observed.

Note: The velocities we got were measured ourselves and times in trials of three

FAN

Work and PE here are equal because they are both the same equation if its about a ball travelling up a tube.

Chemical energy from the fan battery converted into electrical into kinetic pushes the ball up. We needed a foam ball for the fan to push up because the mass of the foam ball is little and the kinetic energy from the fan would not be enough to push a heavier ball up.

W(done by fan on foam ball) = PE at top of fan

PE = mgh

$0.00016\,kg \times 9.81\,m/s^2 \times 0.28\,m = 4.395 \times 10^{-4}\,J$

PROCESS

Loading..

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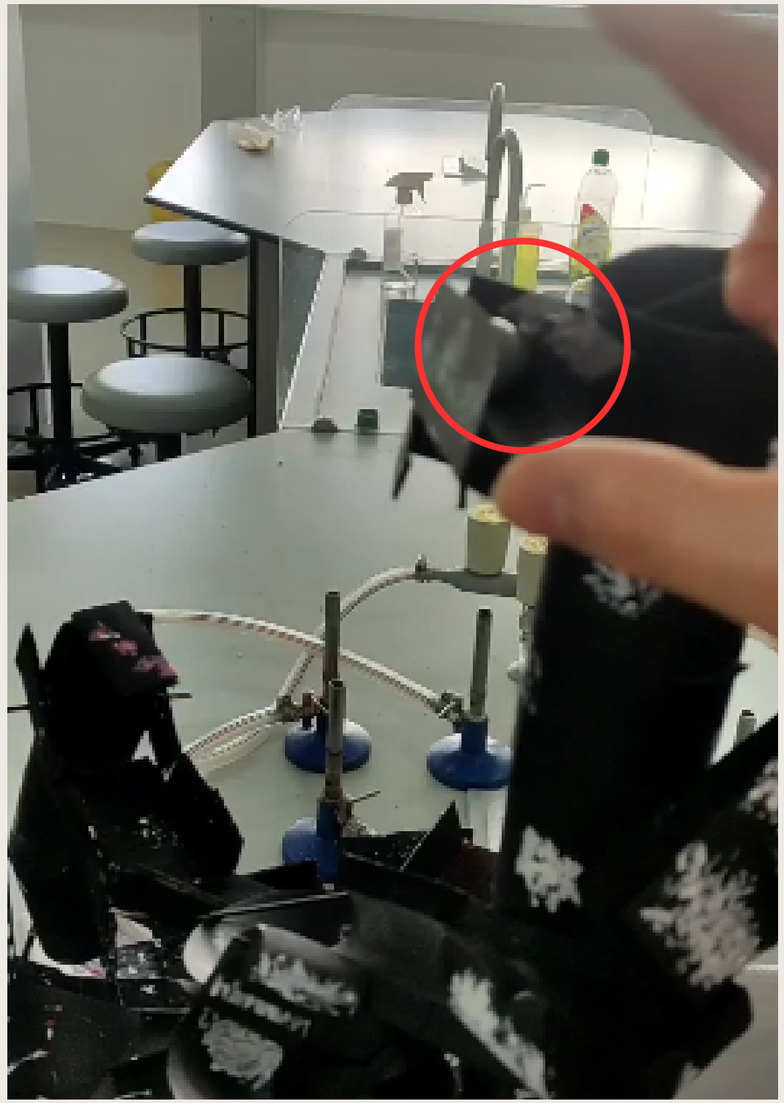
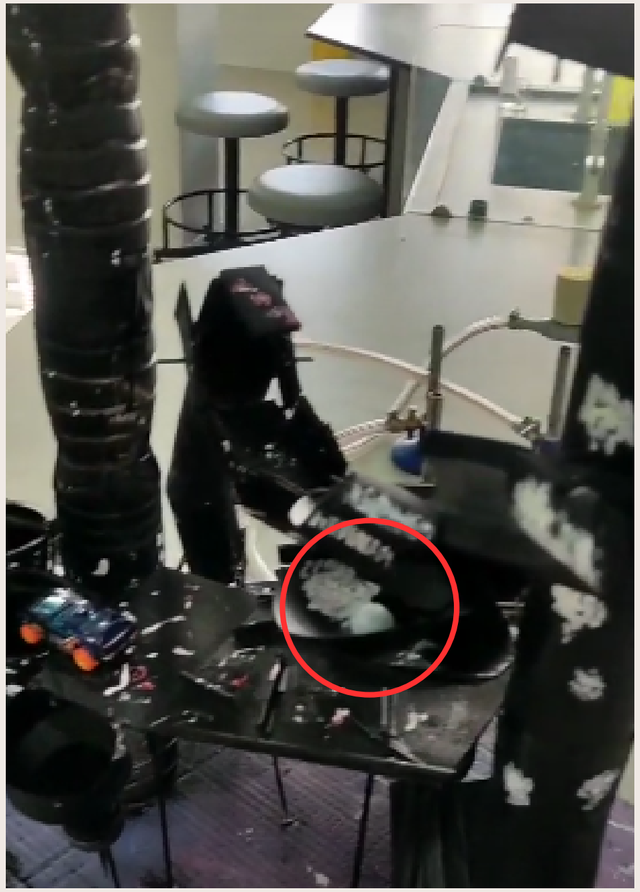
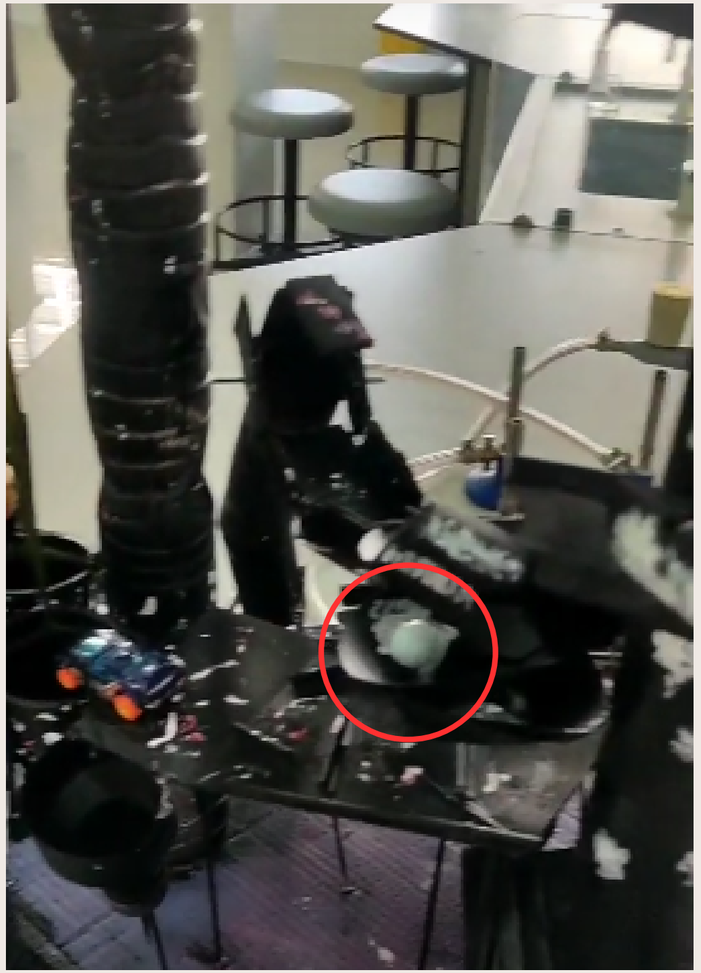
A marble rolls down a spiral made from foam tubes

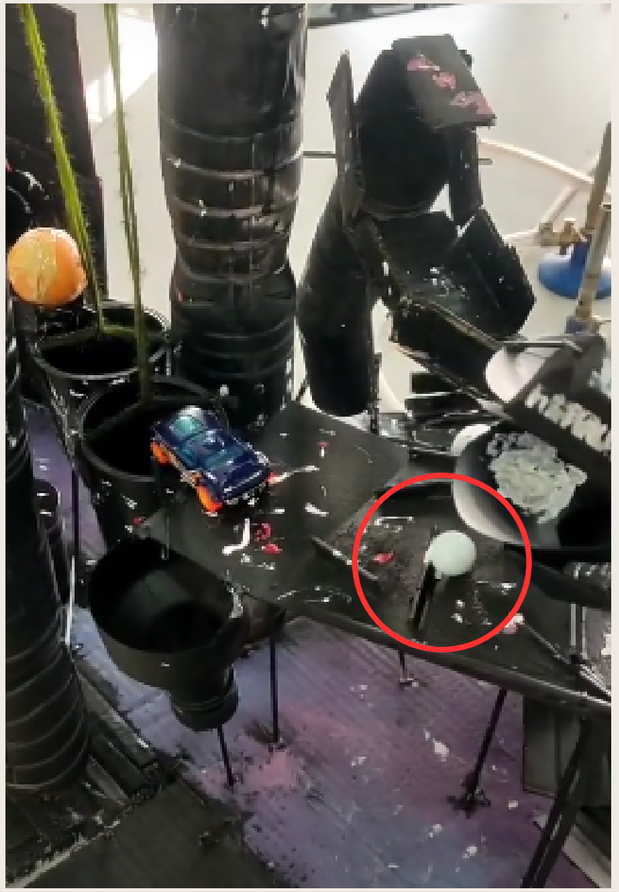
1)



It goes down into 3 funnels and then a slope where it hits obstacles

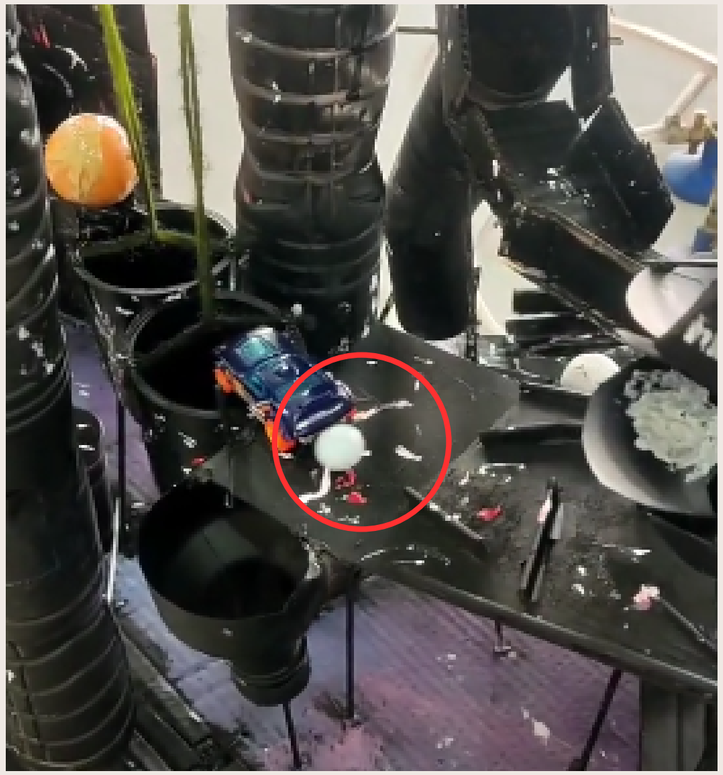


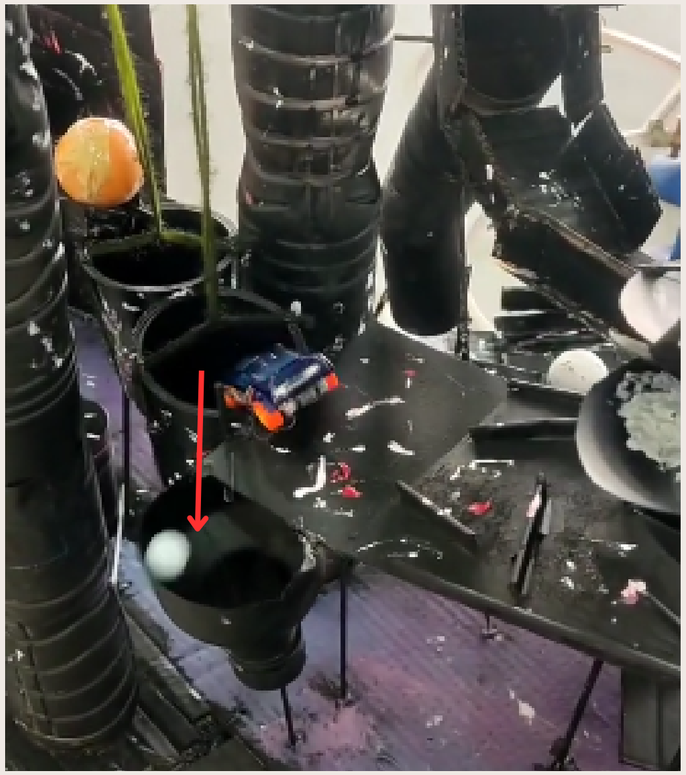




2)

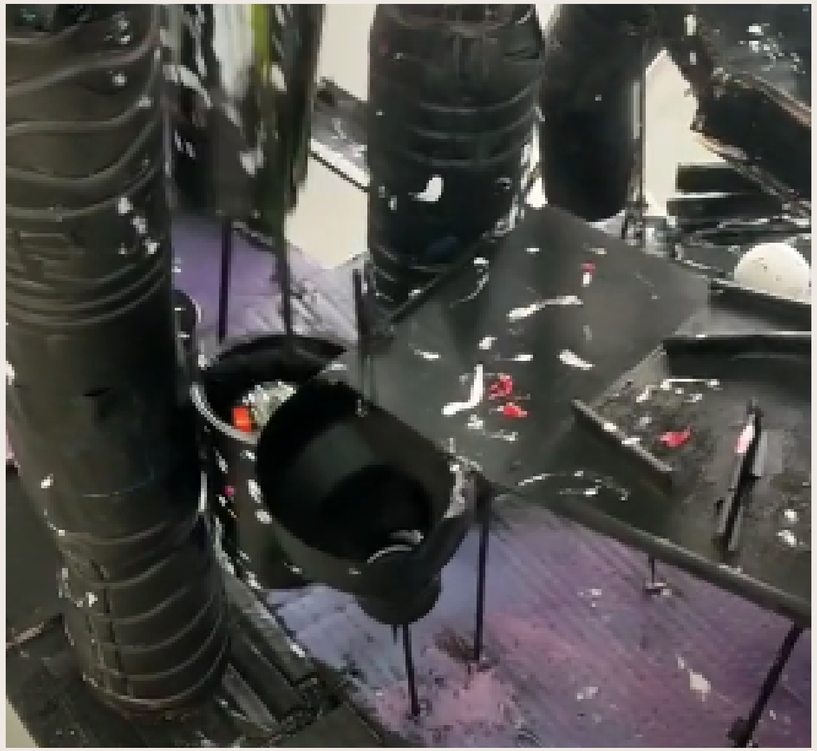
The marble hits a toy car which falls into a cup connected to a pulley

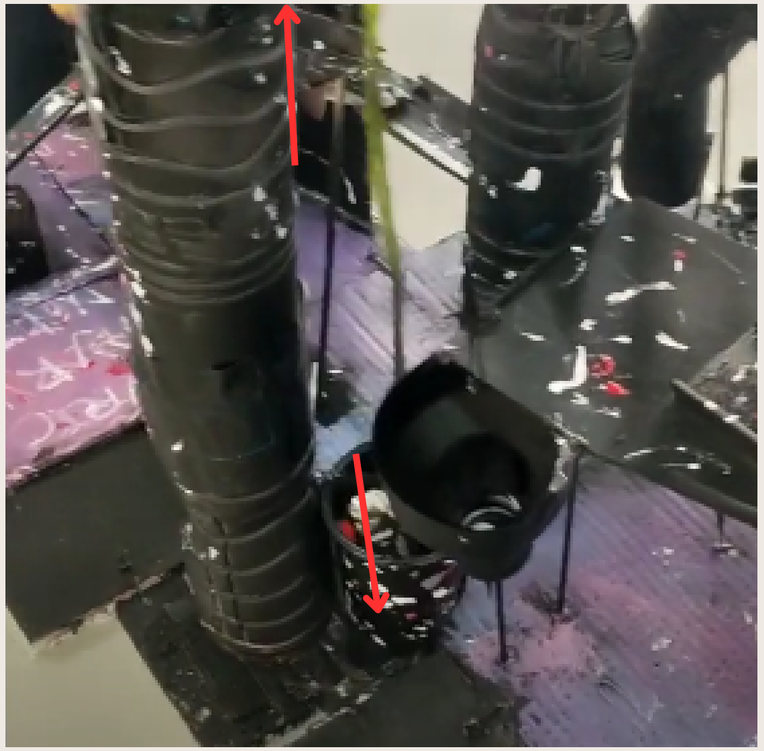




3)

The side with the car goes down while the other side of the pulley goes up



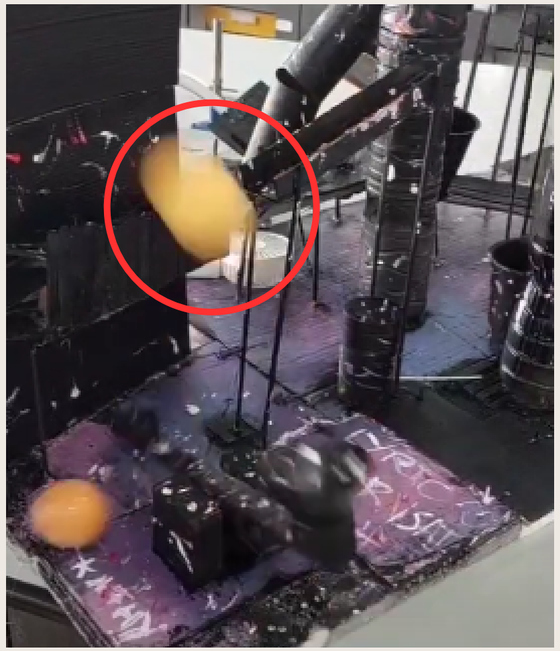


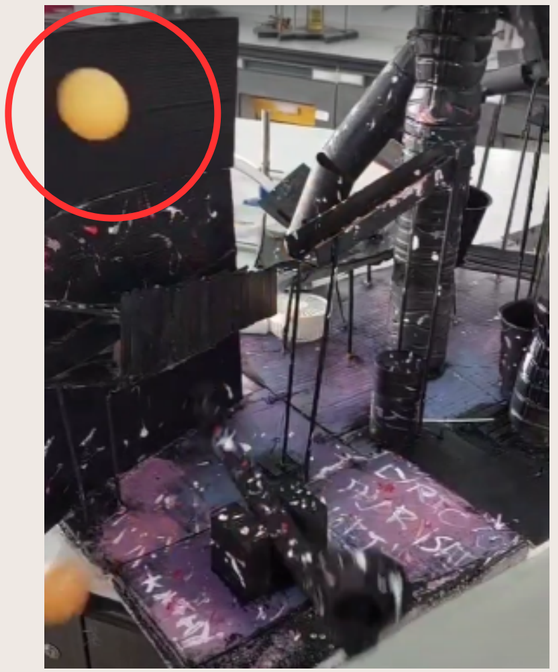
4)

As that side goes up, it pushes a sandball down a slope

5)

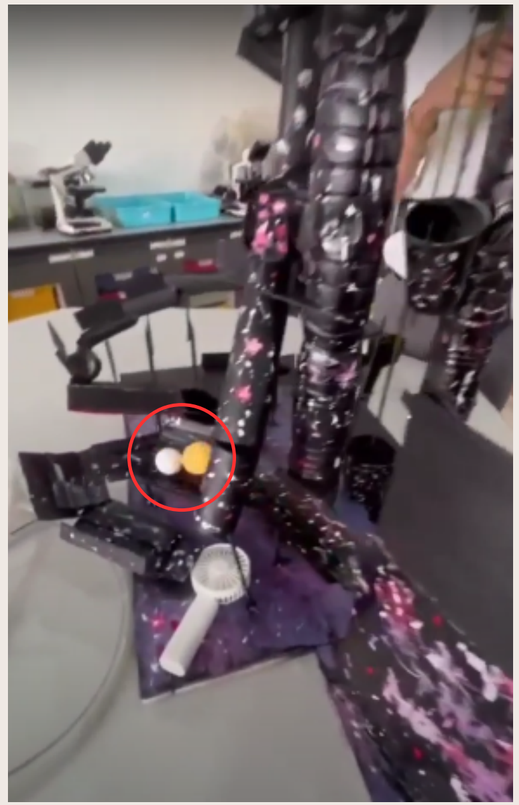
The sandball drops on to a seesaw and catapults a pingpong ball into a wall.





6)

The pingpong rolls down a ramp and collides with a foam ball which creates momentum.



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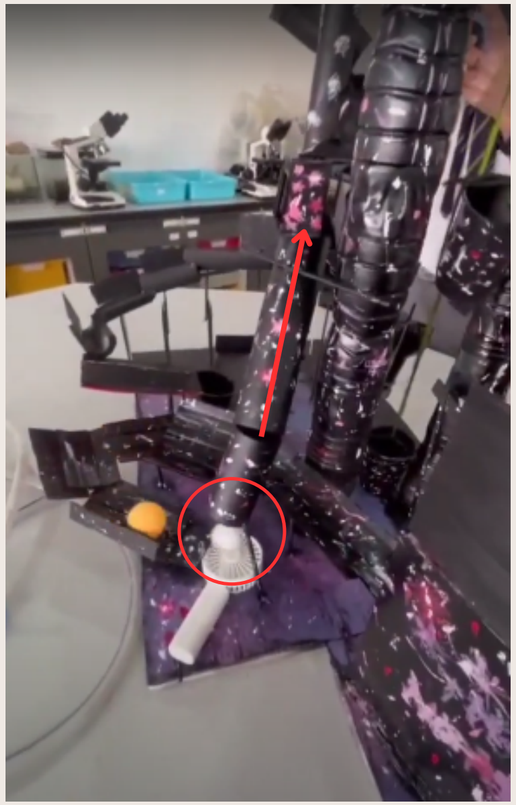
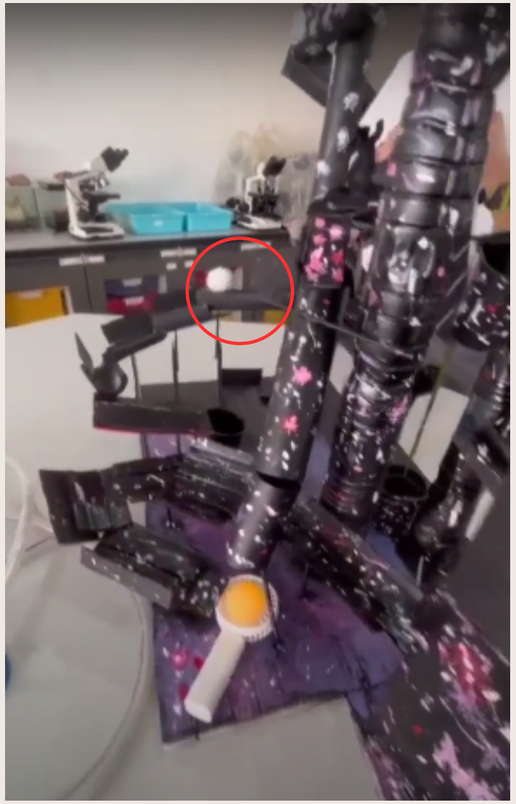
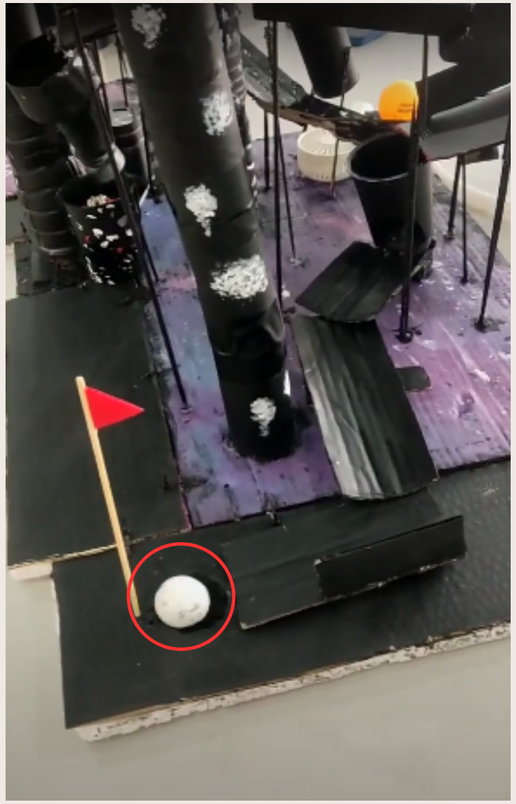


The foam ball and pingpong keeps moving until the foam ball reaches the fan part and is blown up through a tube using converted kinetic energy.

8)

The foam ball continues going down contraptions until it reaches the end.





9)

SCAN

CREATOR

Lyric # 02
North # 07
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INSTRUCTOR

Kru Luke

PHYSICS PROJECT

Panyarat High School